Study of Phytochemical and Antimicrobial potential of some selected wild plants of Baripada, Mayurbhanj district of Odisha

SYNOPSIS

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INTRODUCTION

General Background

Medicinal plants had played a vital role in human civilization since antiquity, serving as the primary source of healthcare for various communities. Before the advancement of synthetic drugs, plants were used as remedies for common ailments such as fever, digestive disorders, infections, and wounds. The therapeutic knowledge was transmitted orally across generations and became embedded in cultural practices and traditions. Ancient systems of medicine, such as Ayurveda, Siddha, and Unani in India, had systematically documented the medicinal use of plants, which indicated their relevance in sustaining human health (Sharma, 2010).

With the progression of scientific methods, the importance of medicinal plants had not diminished but rather gained renewed recognition. Researchers had confirmed that several phytochemicals isolated from plants, such as alkaloids, flavonoids, and terpenoids, exhibited significant pharmacological properties. Drugs like quinine, morphine, and aspirin had originated from plant-derived compounds, demonstrating that plants were not only traditional remedies but also sources of modern drug development (Patwardhan&Mashelkar, 2009).

In modern times, medicinal plants had been extensively studied for their antimicrobial, anti-inflammatory, antioxidant, and anti-diabetic activities. This resurgence was due to the rising global concern of antimicrobial resistance and lifestyle-related disorders, which required safer and more effective alternatives. Plant-based drugs were considered advantageous because they had been perceived

as more biocompatible and less toxic compared to synthetic counterparts. Furthermore, modern analytical tools and bioassay-guided fractionation had provided a scientific foundation to validate traditional claims and identify new bioactive compounds (Kumar et al., 2016).

India, recognized as one of the twelve mega-biodiversity countries, had offered immense potential for medicinal plant research. Regions such as Odisha, particularly Baripada, had remained rich in wild plant diversity, much of which was still unexplored in terms of phytochemical and antimicrobial potential. This unutilized floristic wealth presented a unique opportunity for research that combined traditional ethnomedicinal knowledge with modern pharmacological approaches. Such integration had ensured both conservation of biodiversity and discovery of novel therapeutic leads (Mohanty& Rout, 2018).

The importance of medicinal plants had therefore extended beyond their curative properties; they had also contributed to socio-economic development and environmental sustainability. Rural and tribal populations, especially in Odisha, had depended heavily on wild plants for healthcare, indicating their continuous cultural and practical relevance. Thus, the study of phytochemical and antimicrobial potential of selected wild plants of Baripada, Mayurbhanj district had been not only a scientific necessity but also a contribution to human welfare and ecological balance (Behera&Tripathy, 2015).

Ethnobotany had historically played a vital role in the understanding of the relationship between people and plants. In India, a country renowned for its cultural diversity and rich biodiversity, ethnobotanical traditions had been deeply rooted in daily life. Wild plants had been used not only as food and medicine but

also for cultural rituals, spiritual practices, dyes, construction, and other livelihood needs. Indigenous and rural communities had maintained a vast repository of traditional knowledge concerning wild plants, transmitted orally across generations. This knowledge had laid the foundation for various traditional medicine systems, including Ayurveda, Siddha, and Unani, which had guided healthcare for centuries (Jain, 1991).

Expected Outcomes and Significance

Contribution to Scientific Knowledge on Wild Plants of Baripada

The present research had been expected to significantly enhance the existing body of knowledge regarding the wild plant diversity of Baripada, particularly those species that had remained underexplored. While ethnobotanical surveys in Odisha had catalogued a wide range of medicinal plants, systematic investigations into their phytochemical profiles and antimicrobial potential had been sparse for the Baripada region. By conducting extraction, isolation, and characterization of bioactive compounds, this study had aimed to provide a scientific foundation for plants traditionally regarded as therapeutic by local communities (Panda &Mohanty, 2013).

LITERATURE REVIEW

The government of India, through institutions such as the Ministry of AYUSH, had recognized the relevance of traditional medicine and promoted its integration with modern healthcare systems. National policies had emphasized the need to scientifically validate indigenous remedies to ensure their safety, efficacy, and quality. In this regard, phytochemical and pharmacological studies on wild plants

had assumed significance, especially for regions like Baripada, where ethnomedicinal traditions had been particularly strong (Choudhury, 2011).

India had been recognized as one of the world's twelve megadiversitycenters, housing nearly 45,000 plant species, of which about 7,500 were used in ethnomedicine. This diversity had been complemented by the presence of more than 700 tribal groups, each with its own set of plant-based practices and healthcare traditions. The intersection of biodiversity and cultural plurality had made India an ethnobotanical hotspot of global importance (Puri et al., 1993).

Field studies conducted across Indian states had documented extensive plant use among tribal and rural populations. For instance, communities in Rajasthan, Madhya Pradesh, and Chhattisgarh had relied on wild plants to treat ailments ranging from digestive problems to skin diseases. These ethnobotanical surveys had revealed not only the medicinal relevance of wild flora but also the cultural significance attached to them. Such findings had underscored the urgent need to preserve indigenous knowledge before it eroded under the pressures of modernization (Jain &Rao, 1977).

Significance of the Study in the Context of Odisha's Indigenous Flora

Odisha had been one of the most floristically rich states in India, hosting a wide range of medicinal plants traditionally used by tribal and rural communities. In particular, the Baripada region had served as a reservoir of underutilized wild flora that formed an integral part of indigenous healthcare practices. Despite this, systematic scientific validation of such plants had been scarce, leading to an underappreciation of their medicinal potential. Conducting phytochemical and antimicrobial studies on *C.*

auriculata within this ecological and cultural framework had therefore been of significant value (Patra et al., 2015).

The indigenous communities of Odisha had long relied on wild plants to treat common ailments such as fever, infections, digestive disorders, and diabetes. *C. auriculata* had featured prominently in this local pharmacopeia, particularly for managing blood sugar levels and wound infections. However, the knowledge of these uses had largely remained confined to oral traditions and local healers, without adequate scientific validation. Documenting and analyzing the phytochemical basis of these claims had provided an opportunity to bridge traditional wisdom with modern pharmacology (Panda &Misra, 2011).

Research Objectives

The present investigation entitled "Study of Phytochemical and Antimicrobial Potential of Some Selected Wild Plants of Baripada, Mayurbhanj District of Odisha" was carried out under the following five specific objectives:

1. To study the collection, identification, and authentication of selected wild plant materials from the Baripada, Mayurbhanj district of Odisha.
2. To study the preparation, extraction, and yield determination of plant extracts using solvents of increasing polarity.
3. To study the preliminary phytochemical profile and qualitative screening of bioactive compounds present in the extracts.
4. To study the isolation, purification, and characterization of active principles using chromatographic and spectroscopic techniques.

5. To study the antioxidant and antimicrobial potential of the prepared plant extracts against selected microbial strains.

MATERIALS & METHODS

Study Area and Plant Material

The research will be conducted in the Baripada, Mayurbhanj district of Odisha, a region that will be distinguished by its rich biodiversity and unique climatic conditions. The district will be located in the northern part of the state, positioned between approximately 21°39' to 22°30' N latitude and 86°04' to 87°00' E longitude. Its topography will consist of a diverse mix of plains, rolling uplands, and the dense forests of the Similipal hills, which will serve as a defining feature of its landscape. The Budhabalangariver and its tributaries will contribute to the fertile alluvial soil of the plains.

Plant Material: Collection and Species Description

The plant materials for this study will be collected from various wild species native to the Baripada, Mayurbhanj district. These will include prominent trees such as *Hollarhenna* (*Holarrhen aantidysenterica*), Sal (*Shorea robusta*), Simul (*Bombax ceiba*), Kusum (*Schleichera oleosa*), Kendu (*Diospyros melanoxylon*), Mahua (*Madhuca indica*), and Piasal (*Pterocarpus marsupium*). The collection will be performed from different locations to ensure a representative sample of each species across their natural habitats, which will include forest edges, wastelands, and dry deciduous areas.

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To account for seasonal variations in phytochemical composition, the collection will be carried out during different times of the year, including the summer, monsoon, and winter seasons. After collection, each plant sample will be meticulously identified and authenticated by a professional botanist, and a voucher specimen of each species will be deposited at a designated herbarium for future reference. The collected materials will then be prepared for further analysis, focusing on their phytochemical and antimicrobial potential, as outlined in the study's objectives.

Plant Collection and Identification

- Plant material (*Hollarhenna, Shorea, Bombaxceiba, Schleicheraoleosa, Diospyrosmelanoxylon, Madhucaindica, Pterocarpusmarsupium*) will be collected from specified locations within the Baripada, Mayurbhanj district during different seasons (winter, summer, and rainy).
- A defined procedure will be followed for the collection and storage of samples.
- Botanical identification and authentication will be carried out by a recognized botanist/institution.
- A voucher specimen of each species will be submitted to a herbarium for future reference.

Preparation of Plant Extract

Plant Material Processing

- The plant parts (e.g., leaves, flowers, roots) will be washed, dried (at room temperature or in a hot air oven), and pulverized into fine powder.

Extraction Procedures

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- Sequential extraction will be performed using different solvents in an ascending order of polarity: Hexane, Chloroform, Ethyl Acetate, Methanol, and Water.
- A detailed procedure for maceration or Soxhlet extraction will be followed.
- Filtration and concentration of the extracts will be carried out using a rotary evaporator.
- Extraction yield for each solvent will be calculated.

Storage of Extracts

- Proper storage conditions will be maintained to prevent degradation of the extracts.

Preliminary Phytochemical Screening

Qualitative Phytochemical Screening

- Standard qualitative tests will be performed to detect the presence of secondary metabolites in each extract:

    a. Alkaloids (e.g., Mayer's, Wagner's tests)
    b. Flavonoids (e.g., Shinoda test)
    c. Saponins (e.g., Foam test)
    d. Tannins (e.g., Ferric chloride test)
    e. Steroids and Triterpenoids (e.g., Salkowski test)
    f. Phenols and Polyphenols

Isolation and Characterization of Active Principle

Column Chromatography

- A column using silica gel will be prepared.

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- The most active crude extract will be loaded onto the column.
- Elution with a gradient of solvents will be carried out to separate fractions.

Thin-Layer Chromatography (TLC)

- TLC will be applied to monitor the separation process.
- Appropriate solvent systems and detection methods will be selected.
- Rf values for different spots will be determined.

Spectroscopic Methods for Characterization

- High-Performance Liquid Chromatography (HPLC): The procedure will be used for identifying and quantifying major compounds.
- Fourier-Transform Infrared (FT-IR) Spectroscopy: Functional groups will be identified.
- Nuclear Magnetic Resonance (NMR) Spectroscopy: Structural elucidation (^{1}H NMR and ^{13}C NMR) will be carried out.
- Mass Spectrometry (MS): The molecular weight of the isolated compound will be determined.

Antioxidant Assays

- DPPH and FRSA assays will be conducted.
- Secondary metabolites such as total phenols, total flavonoids, total tannins, and terpenoids will be estimated.

Enzymatic Antioxidants

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- Catalase (CAT) activity assay and Ascorbate peroxidase (APX) activity assay will be performed.

Antimicrobial Potential

- The antimicrobial potential of ethanolic extracts of plant material (Hollarhenna, Shorea, Bombaxceiba, Schleicheraoleosa, Diospyrosmelanoxylon, Madhucaindica, Pterocarpusmarsupium) will be evaluated against selective bacteria such as *Bacillus subtilis, Escherichia coli, Agrobacterium tumifaciens,* and *Bacillus thuringiensis*.

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